

P2 you can do in your finishing shop

Electroplating is a combined electrical and chemical process in which metals such as chrome, silver, gold, zinc, brass, nickel, or copper are deposited onto another base material such as steel or aluminum, thereby altering and improving the surface properties of the base material. Electroplating operations require an electrolyte (plating bath), anodes, a cathode, and an electrical energy source referred to as a rectifier.

The electrolyte is a solution of metallic ions or salts and other components that help control the smoothness and brightness of the finish. The cathode is the piece of metal to be plated and the anodes provide the plating metal. The anodes are placed along the edge of the bath, and replace the metallic ions in solution as they are plated onto the cathodic workpiece. The rectifier provides the direct current causing the metal ions in the plating bath to adhere to the cathode, forming a thin metallic film on the workpiece.

Purposes for plating the workpiece vary as much as the type of cover produced. Key benefits of plating include corrosion resistance, changing the electrical conductivity of the piece, increasing hardness and wear resistance, improving thermal conductivity, or simply decoration. Some examples of “practical” or functional finishes are gold-plated electrical connectors and more durable cadmium-plated products. More “decorative” purposes include gold and silver plating of jewelry, chrome plating of car parts, and brass plating of household goods.

Often times, quality of the final product is as dependent upon pretreatment steps as it is on the plating process itself. Non-uniform coatings, dark spots, roughness, and lack of metal adhesion are often caused by poor surface preparation. Although chlorinated degreasers are common, aqueous cleaning is becoming increasingly popular.

The very nature and purpose of electroplating has led to an increased focus on the environmental impact of the industry. Areas of concern, whether you operate a captive shop or job shop, are air and water releases, and sludge generation. Releases into the atmosphere, including fumes and entrainments, are strictly regulated by the Environmental Protection Agency, especially for chromium. Another area where electroplating operations affect the environment, and the area where several pollution prevention strategies can be implemented, involves both pretreatment and rinsing operations. Also, a few preventative measures can reduce the amount of sludge produced. For more specific pollution prevention ideas, read on....

Assess your facility

Waste assessments help identify amounts and types of waste, as well as sources of hazardous wastes generated at your facility. Know what your wastes are, what goes in the dumpster, what is hauled away, and what goes down the drain. Concentrate your efforts on processes which can decrease costs and chemical toxicity. Knowing these things makes it easier to determine how and where waste can be reduced.

Improve housekeeping and material handling

Use a “first-in, first-out” system for raw materials, thus keeping chemicals from becoming too old for use. Raw material and hazardous waste storage areas should have spill containment or spill control procedures in place. Keep these areas clean. Non-hazardous materials should be kept separate from hazardous wastes. Designate people to handle specific jobs such as maintaining storage areas, accepting and returning chemical samples to suppliers, distributing of raw materials, and inspecting and logging equipment and parts. Remember preventive maintenance is important; conduct periodic inspections of all equipment.



Pollution prevention — Electroplating

Minimize drag-out

Drag-out is the primary source of contaminated rinse water in metal finishing processes. Install drainage boards between process tanks to capture and return drag-out back to the process tanks. Air-knives or spray rinses above the process tank will return excess drag-out back to the tank. Minimizing bath concentrations as much as possible to reduce the amount of potential contaminant leaving with drag-out. Wetting agents reduce solution surface tension and reduce the amount of drag-out.

Recycle

Reusing and recycling can help reduce waste disposal costs. Wastes may potentially be used as raw materials for another process or materials can possibly be recovered before being disposed. Reuse acid rinse effluent as influent to the alkaline rinse tank. Treatment of rinse water effluent not only recovers process bath chemicals, resulting in decreased supply costs, but also allows prolonged rinse bath life.

Reduce water use

Use spray rinses as initial rinses after process tanks. It may be possible to adjust the amount of water supplied to rinsing to make up for evaporative losses from the process baths. Use of countercurrent rinse tanks or other multiple rinse tank systems after process baths improves efficiency and reduces water use. Air agitation or workpiece agitation can also improve rinse efficiency. Finally, treatment technologies may present recycling of rinse waters in a closed loop system.

Implement process changes

Changes to your process can reduce the amount of waste generated. Use alkaline cleaners or ultrasonic cleaning units instead of chlorinated solvents for degreasing operations. Pretreat process waters to reduce natural contaminants and the volume of sludge produced. Replace cyanide processes with carbonitriding or carbonizing. Eliminating process materials such as hexavalent chromium by using trivalent chromium. Any process changes which generate treatable or recyclable waste on-site are desirable. Keep in mind, however, possible changes to product quality or potential creation of other environmental concerns.

Pass on the commitment

Commitment to environmental enhancement and pollution prevention programs begins with you, but does not end there. You must not only be committed to waste reduction and pollution prevention practices, but must also pass that commitment on to fellow employees. Support of both management and employees is needed for any program to succeed. Encourage employees to be involved in developing pollution prevention ideas; establish incentive programs to encourage participation; and train in waste reduction, hazardous material handling, and emergency response.

Keep abreast of improving pollution prevention technologies and applications. Previously implemented as a final treatment for a shop's combined wastewater stream, process-specific reverse osmosis technology is now being utilized. Innovative cooling systems, such as exterior systems used in chrome production, have reduced the rejection rates associated with interior cooling systems. Using conductivity control systems insures chemical concentrations in rinse baths will not build to a level which can interfere with product quality and at the same time reducing overall water use. Replacing solvent degreasers with ultrasonic aqueous cleaning can contribute to a reduction in solvent purchase, storage and disposal costs, improved worker safety and reduced regulation compliance costs. Integrating electrowinning technology into rinse systems can reduce both water use and chemical discharge.

For those with Internet access, several good World Wide Web sites exist. Visit the following web sites for additional sources of information:

- P2IRIS —
<http://www.p2iris.com>
- EPA Sector Notebooks —
<http://es.epa.gov/oeca/sector/index.html>
- National Metal Finishing Center —
<http://www.nmfc.org>
- Institute for Advanced Manufacturing Science (IAMS) —
<http://www.iams.org>
- Enviro\$en\$e Metal Finishing Guide —
<http://es.epa.gov/es-guide/metals/metal.htm>
- Ohio EPA —
<http://www.epa.ohio.gov/opp/fact24.html>



The Small Business Environmental Assistance Program's (SBEAP) mission is to help Kansas small businesses comply with clean air regulations. SBEAP operates through a consortium of the University of Kansas, Kansas State University and Wichita State University. This fact sheet was published by Kansas State University's Pollution Prevention Institute. For more information, call 800-578-8898 or send e-mail to SBEAP@ksu.edu. The University of Kansas, Kansas State University and Wichita State University are EEO/AA providers.